What we claim is,

1. An optical communication device comprising:

a circuit board having a top surface and a bottom surface;

a bench mounted on the top surface of the circuit board;

optoelectronic elements mounted on the bench and having operation for generating or receiving signal light;

light guides for guiding the signal light from or into the optoelectronic elements; and

electronic or electric elements mounted on the bottom surface and on the top surface of the circuit board for realizing the operation of the optoelectronic elements.

2. The optical communication device according to claim 1, wherein the optoelectronic elements on the bench include optoelectronic chips for generating light signals or for monitoring the generated light, and the bench aligns the light guide to the optoelectronic chip.

3. The optical communication device according to claim 2, wherein the optoelectronic chips for generating light signals or for monitoring the generated light are one or two of a photodiode (PD), a laser diode (LD) and a light emitting diode (LED).

4. The optical communication device according to claim 3, wherein the light guide is an optical fiber and a ferrule supported on the bench.

5. The optical communication device according to claim 3, wherein the light guide is a waveguide made on the bench.

6. The optical communication device according to claim 3, wherein the bench is a single crystal silicon bench.

7. The optical communication device according to claim 3, wherein the bench is a ceramic bench.

8. The optical communication device according to claim 3, wherein the optoelectronic chips are a laser diode (LD) for generating transmitting light signals and a monitoring photodiode (PD) for monitoring power of the laser diode, the electronic element laid upon the top surface of the circuit board is an LD-driving IC for amplifying transmitting electric signals and giving the amplified signal current to the laser diode (LD), and the electronic elements mounted upon the bottom surface of the circuit board are an auto power controlling (APC) IC for controlling the power of the laser diode in accordance with the power sensed by the monitoring photodiode.

9. The optical communication device according to claim 8, wherein the light guide is an optical fiber with a ferrule, the bench has a larger V-groove for supporting the ferrule on a lower step and a smaller V-groove for sustaining the fiber, and marks of designating a spot of the laser diode (LD) for aligning the laser diode to the optical fiber.

10. The optical communication device according to claim 9, wherein the bench has marks of designating a spot of mounting the monitoring photodiode (PD).

11. The optical communication device according to claim 10, wherein the monitoring photodiode (PD) is a bottom incidence type PD and the monitoring photodiode (PD) and the laser diode (LD) are coupled by a groove.

12. The optical communication device according to claim 11, wherein the ferrule is capped with a receptacle for coupling to an external optical connector.

13. The optical communication device according to claim 12, wherein the bench is a single crystal silicon bench, and the larger V-groove and the smaller V-groove are made on the silicon bench by anisotropic chemical etching.

14. The optical communication device according to claim 13, wherein the electric elements mounted on the bottom surface of the circuit board are R/C elements which are either resistors or capacitors.

15. The optical communication device according to claim 14, wherein the top surface of the circuit board has a set of outward extending leadpins which are connected to wiring metallized patterns formed on the top surface and the bottom surface of the circuit board has another set of outward extending leadpins which are connected to wiring metallized patterns formed on the bottom surface.

16. The optical communication device according to claim 1, wherein the optoelectronic elements on the bench include optoelectronic chips for generating light signals or for monitoring the generated light, a submount is laid upon the circuit board for supporting the light guide and the bench, and the bench aligns the light guide to the optoelectronic chip.

17. The optical communication device according to claim 16, wherein the optoelectronic chips for generating light signals or for monitoring the generated light are one or two of a photodiode (PD), a laser diode (LD) and a light emitting diode (LED).

18. The optical communication device according to claim 17, wherein the light guide is an optical fiber with a ferrule, the optical fiber is supported on the bench and the submount, and the ferrule is supported on the submount.

19. The optical communication device according to claim 17, wherein the

light guide is a waveguide made on the submount and the bench.

20. The optical communication device according to claim 17, wherein the submount is a liquid crystal polymer and the bench is a single crystal silicon bench.

21. The optical communication device according to claim 17, wherein the submount is a liquid crystal polymer and the bench is a ceramic bench.

22. The optical communication device according to claim 17, wherein the optoelectronic chips on the chip are a laser diode (LD) for generating transmitting light signals and a monitoring photodiode (PD) for monitoring power of the laser diode, the electronic element laid upon the top surface of the circuit board is an LD-driving IC for amplifying transmitting electric signals and giving the amplified signal current to the laser diode(LD), and the electronic elements mounted upon the bottom surface of the circuit board are an auto power controlling (APC) IC for controlling the power of the laser diode in accordance with the power sensed by the monitoring photodiode.

23. The optical communication device according to claim 20, wherein the light guide is an optical fiber with a ferrule, the silicon bench has a narrow V-groove for supporting an end of the fiber, the submount has a smaller V-groove for supporting the fiber and a larger V-groove for sustaining the ferrule on a lower step, and marks of designating a spot of the laser diode (LD) for aligning the laser diode to the optical fiber.

24. The optical communication device according to claim 23, wherein the bench has marks of designating a spot of mounting the monitoring photodiode (PD).

25. The optical communication device according to claim 24, wherein the

monitoring photodiode (PD) is a bottom incidence type PD and the monitoring photodiode (PD) and the laser diode (LD) are coupled by a groove.

26. The optical communication device according to claim 25, wherein the ferrule is capped with a receptacle for coupling to an external optical connector.

27. The optical communication device according to claim 26, wherein the bench is a single crystal silicon bench, the narrow V-groove on the bench is made by anisotropic chemical etching.

28. The optical communication device according to claim 27, wherein the electric elements mounted on the bottom surface of the circuit board are R/C elements which are either resistors or capacitors.

29. The optical communication device according to claim 28, wherein the top surface of the submount has a set of outward extending leadpins which are connected to wiring metallized patterns formed on the top surface of the submount and the bottom surface of the circuit board has another set of outward extending leadpins which are connected to wiring metallized patterns formed on the bottom surface.

30. The optical communication device according to claim 28, wherein the top surface of the circuit board has another set of outward extending leadpins which are connected to wiring metallized patterns formed on the top surface of the circuit board.

31. The optical communication device according to claim 1, wherein the optoelectronic elements on the bench include an optoelectronic chip for receiving light signals, an IC preamplifies signal of the optoelectronic chip, and the bench aligns the light guide to the optoelectronic chip.

32. The optical communication device according to claim 31, wherein the optoelectronic chip is a photodiode (PD) and the IC is a preamplifier IC for preamplifying the signal of the photodiode chip

33. The optical communication device according to claim 32, wherein the light guide is an optical fiber and a ferrule supported on the bench.

34. The optical communication device according to claim 32, wherein the light guide is a waveguide made on the bench.

35. The optical communication device according to claim 32, wherein the bench is a single crystal silicon bench.

36. The optical communication device according to claim 32, wherein the bench is a ceramic bench.

37. The optical communication device according to claim 32, wherein the electronic element laid upon the top surface of the circuit board is a main amplifier for amplifying current preamplified by the preamplifier IC, and the electronic elements mounted upon the bottom surface of the circuit board are one or more than one of a waveform-reforming IC, a timing-adjusting IC and a buffer IC.

38. The optical communication device according to claim 37, wherein the light guide is an optical fiber with a ferrule, and the bench has a larger V-groove for supporting the ferrule on a lower step, a smaller V-groove for sustaining the fiber, and marks of designating a spot of the photodiode (PD) for aligning the photodiode to the optical fiber.

39. The optical communication device according to claim 38, wherein the bench has marks of designating a spot of mounting the preamplifier IC.

40. The optical communication device according to claim 39, wherein the

photodiode (PD) is a bottom incidence type PD and the photodiode (PD) is coupled to the optical fiber by the smaller V-groove with a reflection plane.

41. The optical communication device according to claim 40, wherein the ferrule is capped with a receptacle for coupling to an external optical connector.

42. The optical communication device according to claim 41, wherein the bench is a single crystal silicon bench, and the larger V-groove and the smaller V-groove are made on the silicon bench by anisotropic chemical etching.

43. The optical communication device according to claim 42, wherein the electric elements mounted on the bottom surface of the circuit board are R/C elements which are either resistors or capacitors.

44. The optical communication device according to claim 43, wherein the top surface of the circuit board has a set of outward extending leadpins which are connected to wiring metallized patterns formed on the top surface, and the bottom surface of the circuit board has another set of outward extending leadpins which are connected to wiring metallized patterns formed on the bottom surface.

45. The optical communication device according to claim 1, wherein a submount is laid upon the circuit board for supporting the light guide and the bench, the optoelectronic elements on the bench include an optoelectronic chip for receiving light signals, the bench aligns the light guide to the optoelectronic chip, and an IC preamplifies signal of the optoelectronic chip.

46. The optical communication device according to claim 45, wherein the optoelectronic chip is a photodiode (PD) and the IC is a preamplifier IC for preamplifying the signal of the photodiode chip

47. The optical communication device according to claim 46, wherein the light guide is an optical fiber supported on the bench and the submount and a ferrule supported on the submount.

48. The optical communication device according to claim 46, wherein the light guide is a waveguide made on the bench and the submount.

49. The optical communication device according to claim 46, wherein the bench is a single crystal silicon bench and the submount is made of a liquid crystal polymer.

50. The optical communication device according to claim 46, wherein the bench is a ceramic bench and the submount is made of a liquid crystal polymer.

51. The optical communication device according to claim 46, wherein the electronic element laid upon the top surface of the circuit board is a main amplifier for amplifying preamplified current of the preamplifier IC, and the electronic elements mounted upon the bottom surface of the circuit board are one or more than one of a waveform-reforming IC, a timing-adjusting IC and a buffer IC.

52. The optical communication device according to claim 51, wherein the light guide is an optical fiber with a ferrule, the submount has a larger V-groove for supporting the ferrule on a lower step and a smaller V-groove for sustaining the fiber, the bench has a narrow V-groove for supporting an end of the fiber and marks of designating a spot of the photodiode (PD) for aligning the photodiode to the optical fiber.

53. The optical communication device according to claim 52, wherein the bench has marks of designating a spot of mounting the preamplifier IC.

54. The optical communication device according to claim 53, wherein the photodiode (PD) is a bottom incidence type PD and the photodiode (PD) is coupled to the optical fiber by the narrow groove with a reflection plane.

55. The optical communication device according to claim 54, wherein the ferrule is capped with a receptacle for coupling to an external optical connector.

56. The optical communication device according to claim 55, wherein the bench is a single crystal silicon bench and the narrow V-groove on the bench is made by anisotropic chemical etching.

57. The optical communication device according to claim 56, wherein the electric elements mounted on the bottom surface of the circuit board are R/C elements which are either resistors or capacitors.

58. The optical communication device according to claim 57, wherein the top surface of the submount has a set of outward extending leadpins which are connected to wiring metallized patterns formed on the top surface of the submount and the bottom surface of the circuit board has another set of outward extending leadpins which are connected to wiring metallized patterns formed on the bottom surface.

59. The optical communication device according to claim 58, wherein the top surface of the circuit board has another set of outward extending leadpins which are connected to wiring metallized patterns formed on the top surface.

60. The optical communication device according to claim 1, wherein two light guides and two benches are mounted on the circuit board, the optoelectronic elements on the benches include an laser diode (LD) chip for generating light signals, a monitoring photodiode (MPD) for monitoring the

generated light, and a signal photodiode (PD) for receiving light signals and making photocurrent, a preamplifier IC preamplifies the photocurrent of the signal photodiode (PD), a first bench aligns the laser diode (LD) chip to one of the light guides, and a second bench aligns the signal photodiode (PD) chip to another light guide.

61. The optical communication device according to claim 60, wherein the optoelectronic chips mounted upon the benches are an laser diode (LD) and a monitoring photodiode (MPD) mounted upon one of the benches and a signal photodiode (PD) mounted upon the other bench, one light guide is coupled to the laser diode (LD), and the other light guide is coupled to the signal photodiode (PD).

62. The optical communication device according to claim 61, wherein the two light guides are two optical fibers with ferrules supported on the benches.

63. The optical communication device according to claim 62, wherein the electronic elements laid upon the top surface of the circuit board are an LD-driving IC for amplifying transmitting electric signals and giving the amplified signal current to the laser diode (LD) and a main amplifier for amplifying preamplified current of the preamplifier IC.

64. The optical communication device according to claim 63, wherein the electronic elements allocated upon the bottom surface of the circuit board are an auto power controlling (APC) IC for controlling power of the laser diode (LD) in accordance with power of the monitoring photodiode (MPD), a waveform-reforming IC, a timing-adjusting IC, and a buffer IC.

65. The optical communication device according to claim 64, wherein the electric elements allotted upon the bottom surface of the circuit board are R/C

elements which are resistors or capacitors.

66. The optical communication device according to claim 65, wherein the top surface of the circuit board has a set of outward extending leadpins which are connected to wiring metallized patterns formed on the top surface, and the bottom surface of the circuit board has another set of outward extending leadpins which are connected to wiring metallized patterns formed on the bottom surface.

67. The optical communication device according to claim 1, wherein an LD/PD module is constructed by pairing a PD module and an LD module and encasing the paired LD and PD module with a package,

the LD module including:

a first circuit board with a top surface and a bottom surface;

an LD driving IC mounted upon the top surface of the first circuit board;

an auto power controlling (APC) IC mounted upon the bottom surface of the first circuit board;

a first silicon bench fitted upon the top surface of the first circuit board;

an LD chip and a monitoring PD chip mounted on the first silicon bench;

an end of an optical fiber sustained by the silicon bench; and

a ferrule incasing another end of the fiber and being retained by the first silicon bench,

the PD module including:

a second circuit board with a top surface and a bottom surface;

a first group of ICs mounted upon the top surface of the second circuit board;

a second group of ICs mounted on the bottom surface of the second

circuit board;

a second silicon bench fitted upon the top surface of the second circuit board;

a PD chip mounted upon the second silicon bench for sensing light signals and generating photocurrent;

a preamplifier IC chip mounted upon the second silicon bench for preamplifying the photocurrent of the PD chip;

an optical fiber with an end sustained by the second silicon bench for guiding light signals to the PD chip; and

a ferrule incasing the other end of the fiber and being retained by the second silicon bench.

68. The optical communication device according to claim 67, wherein the first group of ICs mounted on the top surface of the second circuit board is a main amplifier IC for amplifying the preamplified current.

69. The optical communication device according to claim 68, wherein the second group of ICs mounted on the bottom surface of the second circuit board are a waveform-reforming IC, a timing-adjusting IC and a buffer IC.